FRDA REPORT 088

UBC INFORMS* NEWSLETTER
VOLUME 3 #1

BY
SUE WATTS**, EDITOR

*INtegrated FORest vegetation Management Systems

**Department of Forest Sciences
Faculty of Forestry
University of British Columbia

Departmental representative:

Dave Haley
Forestry Canada
Pacific & Yukon Region
Pacific Forestry Centre
506 W. Burnside Road
Victoria, B.C.
V8Z 1M5

June 1989

This report has been reviewed by Forestry Canada and approved for distribution. Approval does not necessarily signify that the contents reflect the views and policies of Forestry Canada. Mention of trade names or commercial products does not constitute recommendation or endorsement for use.

ISSN 0835-0752
ISBN 0-662-17162-4
Fo-19/88E

90-04430/

UNIVERSITY OF BRITISH COLUMBIA
FACULTY OF FORESTRY
FOREST SCIENCES DEPARTMENT

UBC INFORMS☆ NEWSLETTER

Volume 3#1

June 1989

Inside this issue:

UBC INFORMS activities
INFORMS newsletter distribution
The UBC WESTFORR group
Recent UBC Forestry undergraduate theses
Research highlights
- Phosphorus availability in salal-dominated sites
- Conversion of unstocked and understocked salal sites in the CWHa to Douglas-fir
- Dormancy induction treatment influence on western hemlock and western redcedar seedlings
- Crestbrook's Skelly Creek demonstration area
- Nelson Region site preparation demonstration sites
- Foliar herbicide treatments for aspen

Garlon registration update
Upcoming meetings/workshops/short-courses
Organizations of interest to vegetation managers
Vegetation management modelling - VEGPRO
Computerized data bases - a review
- Public data bases
- Forestry data bases

The INFORMS data base - an update
INFORMS keyword listing
INFORMS microcomputer version registration form

Editor: Sue Watts PhD RPF

☆INtegrated FORest vegetation Management Systems

UBC INFORMS ACTIVITIES

The INFORMS project (INtegrated FORest vegetation Management Systems) was established in UBC's Forest Science Department in 1985. The overall role of the project is one of vegetation management (VM) information exchange. Our current activities and commit-ments include the following:

1) Mouthpiece for the recently formed WESTFORR group at UBC (research highlights from the group are included in this newsletter).
2) Maintenance of a computerized bibliographic data base and library of VM publications together with a literature searching service as requested (see the section on forestry data bases in this issue of the newsletter).
3) Production of a semi-annual newsletter covering VM research highlights, meeting schedules, activities of the BC Vegetation Management Research Committee, UBC updates and other relevant news.
4) Coordination of a series of on-campus discussion forums for VM researchers.
5) Development of a VM course for undergraduate forestry students at UBC.
6) Coordination of VM demonstration areas at the UBC Research Forest, Maple Ridge, B.C.

Project funding: Financial support for the INFORMS project is presently provided by a contribution from FRDA Federal Direct Delivery funds, a grant from the Council of Forest Industries, and funding from the UBC Forest Science Department.

•••••

INFORMS NEWSLETTER DISTRIBUTION

The UBC INFORMS newsletter is produced twice yearly in an attempt to organize and formalize VM information exchange. Past issues have covered research highlights, updates on UBC's new WESTFORR group, meeting schedules, meeting reports, minutes of the BC Vegetation Management Research Committee meetings, updates on UBC's computerized bibliography and other topics of general interest to its readership.

The INFORMS newsletter is currently being published as a FRDA document by Forestry Canada. Additional copies of this newsletter can be obtained from the address below:

Forestry Canada
Pacific Forestry Centre
506 West Burnside Road
Victoria, B.C.
V8Z 1M5
Phone: (604) 388-0600

The present circulation of this newsletter includes all MoF Regional Research Officers, Stand Tending Foresters, District Resource Officers-Silviculture, as well as interested individuals from the forest industry, government, university and consulting fields. The original INFORMS mailing list is being maintained under FRDA distribution. *Any mailing list changes, deletions or additions, or requests for back issues* should be directed to Susan Watts, Forest Science Department, Faculty of Forestry, University of British Columbia, 2357 Main Mall, Vancouver, B.C. V6T 1W5 Phone: (604) 228-6316.

•••••

THE UBC WESTFORR GROUP
Cold storage and seedling performance research program

An effective program of forest regeneration depends on a good understanding of how trees grow (Physiology and Biochemistry) and how they interact with the environment (Ecophysiology and Ecology). Research in Canada on the biology of forest trees has in the past not been well supported. UBC's Western Forest Regeneration Research group (WESTFORR) has recently been formed to help remedy this deficiency.

Research efforts by the group will target the first few years of seedling life with emphasis on nursery practise and stock handling. A major group project

on the effects of cold storage duration on photosynthetic recovery and root growth in interior spruce has been initiated.

Conifer seedlings are most resistant to stress during the winter months. The main advantage or purpose of cold storage is to maintain seedlings in this stress-resistant state until they can be planted. Although seedlings in constant cold storage conditions (-2°C) are "winter dormant" they still have some physiological and biochemical activity and are themselves capable of changing. It has been observed that cold storage may reduce the ability of spruce seedlings to root in cold soils (no effect in warm soils). Poor rooting in cold soils is believed to be a major cause of plantation failure in north-central BC. Thus, while cold storage has great advantages, it may induce an undesirable physiological state.

The WESTFORR group will examine this phenomenon at three levels. It will first be necessary to confirm the observation as well as identify those conditions which maximize observable differences. The group will then examine how the potential rates for basic physiological processes such as respiration, photosynthesis, and water uptake are affected by cold storage. At the biochemical level, examinations will be made of carbohydrate and amino acid metabolism, plant hormone concentrations, temperature responses of key enzymes, novel protein induction, etc.

In addition to the above, each faculty member has embarked on independent projects. Some of these are:

Effects on seedling physiology of a daily light regime during cold storage - Dr. Lavender [FRDA Project #F52-41-108]; Stress effects on susceptibility to damage from bright light (*i.e.* solarization) - Dr. Camm; Evaluation of growth promoting soil bacteria as a silvicultural tool - Dr. Chanway; Effects of elevated CO_2 concentrations on seedling growth and physiology - Dr. Guy.

WESTFORR faculty contacts

***Director*: J.P. (Hamish) Kimmins** – Ecosystem Ecologist
Phone: (604) 228-3549

Core Group (new appointments):
Edith Camm – Biochemist (joint appointment with Botany)
Research Responsibilities: biochemical basis of stress resistance and identified physiological problems; photosynthetic biochemistry of conifers.
Interests: photoinhibition and its relationship to other types of stress; organization of chloroplast membranes; photosynthetic recovery following cold storage.
Phone: (604) 228-5223

Chris Chanway – Ecophysiologist
Research Responsibilities: interactions between crop tree seedlings and the physical and biotic environment; ecophysiological implications of global climate change.
Interests: plant competition; plant growth promoting bacteria; conifer seedling mycorrhizal associations; effects of specific litter types (*e.g.* salal) on nitrogen mineralization.
Phone: (604) 228-6019

Phil Burton – Regeneration Ecologist
Research Responsibilities: investigate methods of assessing positive and negative interactions between crop and non-crop vegetation; temporal patterns of secondary succession; assistance with field trials.
Interests: plant competition and competition indices; modelling community development; characterization of the light environment under plant canopies.
Phone: (604) 228-6020

Robert Guy – Physiologist
Research Responsibilities: effects of nursery practise and stock handling on seedling quality; stress physiology and plant-environment interactions of nursery-grown seedlings and naturals; implications of global climate change on forest tree physiology.
Interests: acclimation potential and stress resistance; resource allocation; development of stable isotope techniques as tools in the study of plant physiology and ecology; effects of CO_2-enrichment.
Phone: (604) 228-6023

- Existing faculty members also associated with the group include **D.P. Lavender** and **K. Klinka**.

The WESTFORR group is located on campus at Ponderosa annex B and in Biological Sciences. Contact with any members of the group can be made through the following address:

Forest Science Department
Faculty of Forestry
2357 Main Mall
University of British Columbia
Vancouver, BC
V6T 1W5

●●●●●

RECENT UBC FORESTRY UNDERGRADUATE THESES
Summaries of topics relating to vegetation management

Bysouth, D.B. Factors affecting high elevation regeneration success in the ESSF biogeoclimatic zone. BSF Essay, Faculty of Forestry UBC, April 1989. 36p.

This essay is a review of selected literature concerning the two climax tree species of the ESSF, Engelmann spruce and subalpine fir, and the main environmental factors involved in regeneration success at high elevations. (Supervised by Dr. G. Weetman)

Frier, D.J. The effect of various site preparation methods on the early growth of Engelmann spruce. BSF Essay, Faculty of Forestry UBC, April 1989. 54p.

In this essay both cold stored and hotlift planting stock are assessed and compared for growth performance (in terms of height and stem diameter growth) over three growing seasons since outplanting. A comparison is made of the effects of different site preparation techniques (broadcast burned, mechanically site prepared and untreated) on seedling growth and performance. It was found that the type of site prepared ground had as much of an influence on seedling performance as did seedling stock type. On the broadcast burned ground, hotlift stock had significantly greater height growth response than the cold storage stock. Seedlings growing on the broadcast burned ground had the greatest height and stem growth. (Supervised by Dr. D.P. Lavender)

Oran, R. A brief review of the stagnating Sitka spruce plantations on Northern Vancouver Island with emphasis on salal fine-root biomass. BSF Essay, Faculty of Forestry, UBC, April 1989. 39p.

This essay discusses current thinking and research concerning stagnating Sitka spruce plantations on Northern Vancouver Island. The main factor discussed is the role of competition from the fine root biomass of the dominant salal ground cover. Salal can completely re-invade and cover recently harvested sites within eight years. Other factors discussed are the nutrient status of the soils, the assart effect and resulting fluctuation of available nutrients, and salal's effect on soil characteristics. (Supervised by Dr. J.P. Kimmins)

Pemberton, C.L. Salal eradication and hemlock fertilization at Port McNeill, British Columbia. BSF thesis, Faculty of Forestry, UBC, April 1989. 50p.

This thesis addresses experimentation conducted on northern Vancouver Island in plantations and natural regeneration of western hemlock, Sitka spruce and western cedar, where growth is reduced and chlorosis is apparent five to eight years after establishment. The thesis examines third year response of western hemlock to the effects of N and P fertilizers and salal eradication by brushing and herbicide application. The third year data examined in this thesis departed very little from the data in the previous year. Response to salal removal continued, but on plots where it was the only treatment, it did not have a very positive effect on hemlock growth. A combined N+P fertilization gave the best increase in height growth. (Supervised by Dr. G. Weetman)

The above essays/theses are filed in the MacMillan library at the Faculty of Forestry, UBC.

●●●●●

RESEARCH HIGHLIGHTS

PHOSPHORUS AVAILABILITY IN SALAL-DOMINATED ECOSYSTEMS

FRDA Project #F-52-41-112

A response to fertilization has been shown in "growth checked" conifers growing in organic soils of the CWHb1 subzone on Northern Vancouver Island. The check occurs within eight years of planting and coincides with extensive ground cover by salal (*Gaultheria shallon* Pursh.). The cause of the nutrient deficiencies are not known but may be due to low levels of nutrients in the soil, direct competition by salal or the phytotoxic effects of organic acids produced by salal and/or degradation of organic material on site.

The fundamental processes of phosphorus retention in these soils are not well understood. To optimize benefits from the cost of fertilizing, studies to describe and quantify phosphorus sorption and immobilization/precipitation processes have been implemented to complement ongoing fertilization trials, and to study the relative importance of the above effects and their implications for phosphorus supply.

Specific objectives of this project are as follows;

1) To determine if salal is a vigorous competitor for phosphorus.
2) To determine if the degree of competition increases with increased salal cover with time after burning.
3) To determine if phosphorus supply is also restricted in the absence of salal.
4) To determine whether the presence of decomposing cedar wood has an inhibitory effect on phosphorus uptake.
5) To determine if alleviation of acid conditions by liming will increase phosphorus availability.

Methodology

Initially, greenhouse studies at UBC involved bioassay of seedlings of Sitka spruce, western hemlock and western red cedar grown in soils collected from a chronosequence of sites. Phosphorus retention is being studied in these soils via conventional techniques, and turnover and uptake is being considered using a pulse-labelling technique involving the radioactive tracer ^{32}P. That is, the rate of phosphorus cycling is expressed by the rate at which ^{32}P leaves the labile soil phosphorus pool after labelling. The total amount of ^{32}P recovered by the plant, measured over a time course, is used to determine what proportion of the applied ^{32}P has gone into the plant, and at what rate, and hence what proportion into the non-labile pools.

This technique is being used to consider the relative retention characteristics of soils with time after burning. To correlate this with salal cover and the degree of check of the trees, it will also be applied in the field in similar soils with and without the presence of salal and the relative immobilization by all competing sinks considered.

The degree of competition exerted by salal is also being considered in field and greenhouse bioassays examining the relative uptake of ^{32}P by different tree species and by salal. These studies should give direct information on the role of salal in resource competition. This is not to suggest that phosphorus is the pivotal resource in the competitive balance of these ecosystems, more that competition for phosphorus warrants study because its supply is so localized - because phosphate ions are almost immobile in the soil, the effective uptake zone is within a few millimetres of a root and its associated mycorrhizae. Thus, individual roots of neighbouring plants must be very close to each other to compete for the same ions at the same time. If salal is producing phytotoxic substances which restrict root growth or mycorrhizal development, direct competition may not be a determining factor.

The pulse-labelling technique is also being used in greenhouse studies involving bioassay tree seedlings growing in media containing varying amounts of decaying cedar wood to determine its influence on phosphorus supply. Similarly, the technique is used to examine the effects of liming on phosphorus supply. Field liming/fertilization trials have also been established at Port McNeill in Sitka spruce stands subject to growth check.

Contact: Dr. Morag McDonald, Forest Science Department, Faculty of Forestry, 2357 Main Mall, University of British Columbia, Vancouver, B.C. V6T 1W5 Phone: (604) 228-6027

•••••

CONVERSION OF UNSTOCKED AND UNDERSTOCKED SALAL SITES IN THE CWHa TO DOUGLAS-FIR

FRDA Project #F52-31-009

Competition from salal (*Gaultheria shallon*) may be a significant factor in the poor early performance of some Douglas-fir plantations in the CWHa.

A research trial, co-funded by Canadian Forest Products and FRDA, was established in 1987 to determine the effectiveness of stock type, fertilization and mechanical scarification in converting backlog NSR sites to Douglas-fir plantations. Annual height growth, leader length and caliper, and length of laterals in addition to survival were measured as parameters of performance. The results will point to treatments that will rehabilitate these understocked salal sites. Although monitoring is not scheduled to extend to the free-to-grow stage, the potential for any treatment to result in stocked, free-growing stands will be assessed.

Data has been collected for the first two years and analysis is in progress. Compilation of the second year measurements will reflect the effectiveness of controlled release fertilizers on increasing the early height increment of container planting stock. Initial analysis indicates a negative effect of fertilizer on bareroot stock. Final measurements are scheduled for the fall of 1989.

Contact: Alan McLeod, Canadian Forest Products Ltd., Woss, B.C. Phone: (604) 281-2481

•••••

DORMANCY INDUCTION TREATMENT INFLUENCE ON WESTERN HEMLOCK AND WESTERN REDCEDAR SEEDLINGS

FRDA Project #F52-41-010

This FRDA sponsored research program is examining western hemlock and western redcedar to try and gain a better understanding of the influence of nursery cultural practices on seedling morphology and physiology.

The first phase of the program examined stock quality characteristics of seedlings treated with different dormancy induction treatments. Preliminary data reported at the 1988 nursery meeting in Vernon described a new approach to stock quality assessment and reported on the influence of dormancy induction treatments on seedling physiology. Western hemlock seedlings in the short-day treatments and western redcedar seedlings in the moisture stress treatments had the best stock performance potential characteristics. Reprints of the Vernon paper and a FRDA report on western hemlock are available through normal FRDA distribution sources.

The second year of the program entailed planting western hemlock and western redcedar seedlings from the different dormancy induction treatments on a reforestation site and monitoring seedlings physiological and morphological patterns. Data indicates that western hemlock seedlings from the different stocktypes have different physiol-ogical and morphological response patterns to reforestation site conditions. However, the differences between stocktypes is not always perfectly clear due to a mild growing season and variability of planting microsites found on the reforestation site. Results are being written up at this time and will be presented at conferences this summer and fall (e.g. ASPP/CSPP, IUFRO ecophysiology workshop & nursery meeting) and submitted to scientific journals (Can. J. For. Res., Can. J. Bot. & Tree Physiol.) for publication.

Work is presently ongoing to assess the seedlings' physiological and morphological response during the second growing season on the reforestation site.

Contacts: S.C. Grossnickle, Forest Biotechnology Centre, B.C. Research, 3650 Wesbrook Mall, Vancouver, B.C. V6S 2L2 Phone: (604) 224-4331 *or*, J.T. Arnott, Forestry Canada, 506 West Burnside Road, Victoria, B.C. V8Z 1M5 Phone: (604) 388-0600

•••••

CRESTBROOK FOREST INDUSTRIES LTD. SKELLY CREEK DEMONSTRATION AREA

FRDA Project #F52-41-115

Crestbrook Forest Industries (in cooperation with Forestry Canada and JMJ Holdings Inc.) has established a FRDA research demonstration area on a south-facing site in the ESSFc biogeoclimatic subzone of the Skelly Creek drainage near Creston, B.C. The study is investigating the effects of prescribed burning and ground skidding on vegetation redevelopment, Engelmann spruce seedling growth and microclimate.

The site was logged in 1983, burned in 1984 and planted in 1985 with 313 Engelmann spruce plugs. Sampling initiated in 1988 indicates that the early seral vegetation complex present is fireweed (*Epilobium angustifolium*) dominated. Mean vegetation cover values range from 33% in burned areas to 5% on the compacted centres of skid trails. Burned sites are dominated by fireweed, shrub cover is low. Burning seems to inhibit the growth of Utah honeysuckle (*Lonicera utahensis*). Unburned sites have a lower cover of fireweed. They support a variety of shrub species such as Utah honeysuckle, falsebox (*Paxistima myrsinites*) and black blueberry (*Vaccinium membranaceum*).

Skid trails were subdivided into three categories for sampling. The uphill edge, middle and down-slope edge demonstrate differing patterns of revegetation and conifer growth. Vegetation cover is highest in the sidecast material on the down-slope edge of sampled skid trails. The dominant species on either edge of the trails is fireweed. The compacted centres have a low cover of vegetation.

Natural regeneration of subalpine fir is restricted to the unburned area. Douglas-fir regenerated infrequently and only on the up-slope side of the skid trails. Wildlife utilization on this site is moderate. Shrub browse by mule deer, elk, and moose is very common.

A growth response to treatment is evident in Engelmann spruce seedlings after one year's sampling. The best overall seedling performance is on the down-slope side of skid trails. This could be the product of down-slope movement of nutrients from the mixture of organic and mineral horizons in the side cast material as well as moisture moving off the skid trail. The loose friable nature of the side cast material makes root growth, initially, easier than in the soils of undisturbed areas or the compacted middle of skid trails.

Burned areas and the up-slope sides of skid trails demonstrate the next best overall conifer growth. Burning removes competitive vegetation, briefly, and releases some nutrients. The mixing of organic with mineral soil horizons on the up-slope side of the skid trail may release some nutrients that enhance seedling growth. The up-slope side of a skid trail may be drier than the down-slope side.

Unburned sites produced seedlings that were generally smaller than those measured on other sites. Although undisturbed vegetation cover is not high it may compete with conifers for moisture on this well drained, south-facing slope.

The compacted tops of skid trails produced the poorest conifer growth overall.

Microclimatic factors being assessed with three CR-10 data loggers are soil moisture, soil temperature, air temperature, sunlight, wind speed, rainfall and relative humidity. This data will eventually be transferred, summarized and analyzed. The results will, hopefully, help to clarify some of the hypotheses presented in this summary.

Sampling will resume in 1989 with an increased number of transects in the unburned area and some new transects in an adjacent undisturbed forested stand.

Contacts: Maureen V. Ketcheson, JMJ Holdings Inc., P.O. Box 784, Nelson, B.C. V1L 5P9 Phone: (604) 354-4913 *or*, Dave Basaraba, Crestbrook Forest Industries, P.O. Box 4600, Cranbrook, B.C. V1G 4C7 Phone: (604) 426-6241

•••••

NELSON REGION SITE PREPARATION DEMONSTRATION SITES

FRDA Project #3.21

The Ministry of Forests, Forest Sciences Section and JMJ Holdings Inc. of Nelson, B.C. have established three FRDA forestry demonstration areas in the ICHa2 biogeoclimatic subzone of the

Nelson Forest Region. These areas are known collectively as FRDA Project 3.21. They are located at Blackwater Ridge (near Golden), Begbie Creek (near Revelstoke), and Murphy Creek (near Rossland). The objective of the vegetation component of these projects is to describe the effect of several site preparation treatments on early seral plant communities. The pretreatment vegetation of each area is distinct, representing locally common early seral species complexes. Site preparation treatments were completed in the fall of 1987. Permanent vegetation transects were initiated in the summer of 1987.

Blackwater Ridge is a west-facing slope that supports a central tall shrub community dominated by trembling aspen (*Populus tremuloides*) and thimbleberry (*Rubus parviflorus*) and is surrounded by a low growing falsebox (*Paxistima myrsinites*) - soopolallie (*Shepherdia canadensis*) community. Site preparation treatments consisted of mechanical scarification, manual cutting, and herbicide application. Results from data collected one growing season after the treatments indicate that mechanical or manual cutting reduced the cover of falsebox but not thimbleberry. However, the herbicide treatment was effective for reducing the cover of thimbleberry but not falsebox. Utilization of this site by ungulates increased dramatically after mechanical and manual treatments.

Begbie Creek is a northeast-facing lower slope dissected by gullies. The vegetation complexes on this site consist of a tall herbaceous bracken (*Pteridium aquilinum*) - fireweed community and a tall shrubby western hemlock - thimbleberry community which dominates residual areas and slash piles. Treatments in this area were mechanical scarification, manual "knock-down" of mature bracken and herbicide application. Results one growing season after treatment indicate considerable variability in the effective-ness of treatments and the response of vegetation to treatment. Physical constraints presented by residual vegetation created uneven application of treatments. Generally, the herbicide treatment was the most effective in reducing total vegetation cover, particularly when the pretreat-ment vegetation was bracken-dominated. Many of the planted Engelmann spruce seedlings have been browsed by ungulates. Damage is particularly heavy along openings created by mechanical scarification.

Murphy Creek is a south-facing slope dominated by fireweed. The treatments on this site were mechanical scarification, herbicide application and prescribed burning. Data collected one year after the treatments indicated that the herbicide, mechanical and control areas all experienced a similar reduction in total vegetation cover. It is hypothesized that this is not only a consequence of treatment, but also a product of disturbance by trampling from personnel associated with vegetation surveys, tree planting and site preparation. Fireweed-dominated vegetation seemed to be particularly sensitive to trampling. The burn treatment was located in residual western redcedar - falsebox. Burning eliminated residual vegetation and rapidly produced a flush of fireweed and thimbleberry. Wildlife utilization is low on this site.

An establishment report and a report documenting the results one growing season after treatment have been submitted. Vegetation data will be collected in 1989 and a summary report presented. It is hoped that monitoring of vegetation on this site will continue after the present FRDA agreement expires in 1990.

Contacts: Maureen Ketcheson, JMJ Holdings Inc., Box 784, Nelson, B.C. V1L 5P9 Phone: (604) 354-4913 *or*, Chris Thompson, Ministry of Forests, 518 Lake Street, Nelson, B.C. Phone: (604) 354-6200

•••••

FOLIAR HERBICIDE TREATMENTS FOR ASPEN – An operational viewpoint from John Casteel, Lakeland Mills Ltd., Prince George, BC

Background

The biogeoclimatic zones to the north and west of Prince George provide ideal habitats for aspen regeneration, particularly after clearcut logging and mineral soil exposure. Aspen has always been considered a weed species in this area, primarily due to a lack of demand by conversion facilities. However, this situation may change in the near future and silvicultural efforts may well be needed to grow aspen on these sites.

At present, lodgepole pine (with minor percentages of Douglas-fir and white spruce) occupies these sites which are drumlanized till plains left by the last glacial retreat. Huge forest fires over the past 140-160 years have created ideal conditions for the development of clonal aspen clumps of one to twenty hectares in size. As harvesting takes place, these decadent rotten aspen stands are converted into aspen sucker regeneration. Burning and site preparation both seem to stimulate suckering. Lakeland has had very little success (mostly failure) with pre-logging or post-logging tree injection using 2,4-D or Vision. Soil active Velpar has also proved ineffective. Although these treatments kill the residual stumps, they also stimulate suckering and are not operationally effective.

In 1985 Lakeland began aerial application of Roundup with six litres of product and 100 litres of water carrier. This treatment was followed up after six weeks with mechanical site preparation, and has been successful in plantation establishment. Each year Lakeland has reduced both product, carrier volume and percentage of block treated. Several companies now use 5, 4, or 3 litres of product with 75, 50 or 35 litres of water carrier. All of these treatments appear to be effective for aspen control in the latter half of August and early September. The benefits (dollars and sense) of this lowered usage are both economical and improved conditions for fish and wildlife.

Results

A feature of Lakeland's operational aerial herbicide program is <u>not</u> spraying the entire cut block in a strip wide fashion. Aspen growing in clonal clumps represents severe competition for lodgepole pine which is the primary species of concern and which requires as much sunshine as possible. Only the portions of the cut blocks requiring conifer release (to eliminate the aspen) are sprayed. Over the past three years Lakeland has found this selective spraying to be economically acceptable .

Another feature of Lakeland's spray program is that the primary moose browse species such as dogwood and willows tend to be stimulated to produce more suckering of usable browse after two or three years. In addition, the perimeter of the sprayed areas offers improved wildlife habitat through the "edge effect".

The selective spraying of aspen clumps has not proved to be a problem to helicopter companies in the Prince George area. Fixed wing application may be possible but it would require precision timing for spray to hit selected target areas using "on-off" spraying.

Contacts: John Casteel, Lakeland Mills Ltd., P.O. Box 1358, Prince George, B.C. V2L 4V4 Phone: (604) 564-6810 *or*, Dave King, Ministry of Environment, Fish and Wildlife Branch, 1011 4th Avenue, Prince George, B.C. V2L 3H9 Phone: (604) 565-6145 *or*, Dave Coopersmith, Ministry of Forests, 1011 4th Avenue, Prince George, B.C. V2L 3H9 Phone: (604) 565-6100

Lakeland is also involved in FRDA Project #F52-31-007 which is testing backlog reforestation options.

•••••

GARLON REGISTRATION UPDATE

Garlon 4 was granted a registration in March, 1989 for broadleaf weed and woody plant control via ground application to industrial sites, non-cropland and rights-of-way. The registration number is 21053 under the Pest Control Products Act. Full registration including aerial application and use for silviculture purposes is expected upon the review of recently completed environmental studies by Agriculture Canada and the federal agencies involved in the registration review process.

Contacts: T. MacKay, Dow Chemical Canada Inc., 170 Attwell Drive, Rexdale, Ontario. Phone: (416) 674-3540.

•••••

UPCOMING MEETINGS/ WORKSHOPS/ SHORT-COURSES

MECHANICAL SITE PREPARATION – Equipment demonstrations (FRDA SITAC sponsored)

Dates: July 10 through July 13, 1989 (one-day sessions repeated three times)
Place: Salmon Arm
Contact: April Anderson at (604) 365-7292 local 363.❑

MECHANICAL SITE PREPARATION
Field training in the Prince George area
(FRDA NITAC sponsored)

Dates: Six one-day sessions: July 11, 12, and 13, and October 3, 4 and 5, 1989
Place: Prince George
Contact: Sybille Haeussler at (604) 847-9451.❑

THE CHALLENGE OF REGENERATING HIGH ELEVATION SITES
Short-course (FRDA SITAC sponsored)

Dates: Various dates from July 24 through September 21, 1989
Places: Cranbrook, Invermere, Merritt, Lillooet, Clearwater, 100 Mile House, Revelstoke, Grand Forks, Castlegar, Nelson, Kamloops, Golden and Vernon
Contact: April Anderson at (604) 365-7292 local 363.❑

FUNDAMENTALS OF FOREST VEGETATION MANAGEMENT
Short-course for the Southern Interior
(FRDA SITAC sponsored)

Dates: Various dates from July 24 through August 30, 1989
Places: Williams Lake, 100 Mile House, Revelstoke, Golden, Vernon, Salmon Arm, Penticton, Clearwater, Nelson, Castlegar, Lillooet and Merritt
Contact: April Anderson at (604) 365-7292 local 363.❑

SISCO SUMMER WORKSHOP

Date: August 16-17, 1989
Place: Merritt
Theme: Managing mid-elevation forests - an integrated resource perspective
Format: 2 days of field trips examining the PHSP process and integrated resource use in the area
Contact: Abbey Bates at (604) 828-4169.❑

FUNDAMENTALS OF FOREST VEGETATION MANAGEMENT
Short-course for the Coast
(FRDA CTAC sponsored)

Dates: Various dates from September 6 through September 28, 1989
Places: Terrace, Queen Charlotte City, Port McNeill and Nanaimo
Contact: Dan Lousier at (604) 758-7299.❑

VEGETATION MANAGEMENT SEMINAR
(Jointly sponsored by the UBC Research Forest and Monsanto Canada)

Date: October 3-5, 1989
Place: UBC Research Forest, Maple Ridge, BC (accommodation will be available on site)
Format: The format will combine a series of short oral presentations (indoors) and field tours/ demonstrations (in the Research Forest).
Invited speakers will present topics during the morning sessions and the afternoon of the first day. The afternoons of the second and third days will include field tours and demonstrations within the Research Forest.
Topics to be covered include the following:

- Herbicide use in BC
- Pesticide regulation in BC
- Human safety
- Environmental impacts
- Vegetation management techniques and results

Contacts: For further details contact either Dusan Dodic (UBC Research Forest) at (604) 438-8148 or Larry Taylor (Monsanto) at (604) 943-0119.❑

BC VEGETATION MANAGEMENT RESEARCH COMMITTEE – ANNUAL WORKSHOP

Date: November 14-16, 1989
Place: Westin Bayshore Hotel, Vancouver

and

Date: March 6-7, 1990
Place: Inn of the North, Prince George

Theme: **Integrated vegetation management decision making**

Objectives:

- To address current issues relevant to the integration of vegetation management into long term forest management decision making.
- To provide resource managers and researchers with current research information and an opportunity to evaluate new computer tools.
- To provide participants with a synthesis of current information relevant to the vegeta-tion management decision making.

Audience: Approximately 200 participants are expected at each location. Participants will include local research and senior operations staff as well as individuals from the USA.

Format: The format will combine oral presentations, poster sessions, discussion groups and computer tool demonstrations.

Oral presentations
Invited speakers will present specific topics during the first day. The morning sessions will address **silvicultural and other considerations of vegetation management**. Issues to be discussed include silvicultural gains, economic considerations and impacts on other resources. The afternoon continues with invited speakers presenting papers on the **long term management issues associated with vegetation management** (management objectives, wood quality, growth and yield). Also, two case studies concerning the **nature of competition and interference** will be presented. The case studies for the Vancouver meeting will be the salal ecosystem and the wet mixed shrub ecosystem.

Poster sessions
Posters presenting recent research results will be on display during the entire meeting. Several blocks of time will be reserved during the two day meeting for direct interaction between meeting participants and the poster producers.

Discussion groups
Discussion groups will provide participants with the opportunity to discuss vegetation management decision making. Participants will develop management plans, consider long term objectives and positive and negative impacts of vegetation management treatment alternatives. The Vancouver session will focus on coastal alluvial sites and the Prince George session will consider high elevation ESSF sites.

Computer demonstration sessions
Participants will be introduced to some new computer tools useful for vegetation management decision making. A hands-on session will allow participants to spend 15-20 minutes at each station working with the computer programs.

Tentative timetable

Tuesday November 14

5:00-7:00pm	Poster setup
7:00-11:00pm	Registration and poster session

Wednesday November 15

8:30-8:45am	Introduction
8:45-10:00am	Vegetation management: silvicultural considerations
10:00-10:30am	Coffee
10:30-Noon	Vegetation management: other considerations
Noon-1:00pm	Lunch
1:00-2:00pm	Long term management issues
2:00-3:00pm	Competition and interference: two case studies
3:00-3:30	Coffee
3:30-9:00pm	Poster sessions

Thursday November 16

8:30-9:00am	Introduction to discussion topics
9:00-11:30am	Vegetation management alternatives - discussion groups
1:30-1:00	Computer demonstrations and lunch
1:00-4:00pm	Computer tools workshops
3:00-5:00pm	Business meeting

Contact: For further information on the Vancouver meeting, contact Evelyn Hamilton, Research Branch, Ministry of Forests, 31 Bastion Square, Victoria, B.C. V8W 3E7 Phone: (604) 387-3650 [Fax: (604) 387-5685]

•••••

ORGANIZATIONS OF INTEREST TO VEGETATION MANAGERS

An update from the previous INFORMS newsletter

THE NORTHERN INTERIOR VEGETATION MANAGEMENT ASSOCIATION

This Association (NIVMA) is now fully active with nine industry and three government members. Bob Holtby has been appointed a full time manager and a Board of Directors is now in place. A newsletter is produced periodically, the most recent issue being volume 1, number 2, dated mid April 1989.

One of the first activities of NIVMA was a FRDA funded contract to develop an annotated bibliography of the vegetation management (VM) trials already initiated by the NIVMA membership, and to classify these to the standards required for the Reforestation Information Bank data base. More than sixty trials over the past two to three years were reported. A system is now in place to continue to gather VM trial results.

A "Unified System of Silvicultural Monitoring" is being developed for use by the membership. The first version of this document is presently being reviewed. The monitoring system is being developed to serve a number of purposes. It will provide a base level protocol for VM demonstration work on the effects of site specific VM techniques on the crop seedlings; it will allow for efficacy data collection in a common data base for shared use by the membership, and it will combine existing protocols to avoid duplication.

Contact: Bob Holtby, Northern Interior Vegetation Management Association, 906-550 Victoria Street, Prince George, B.C. V2L 2K1 Phone: (604) 564-3770 [Fax: (604) 563-1695]

•••••

VEGETATION MANAGEMENT MODELLING

"VEGPRO" A FOREST VEGETATION MANAGEMENT PRESCRIPTION OPTIMIZATION AND INFORMATION SYSTEM

(This article is the first in a series on vegetation management models. Further articles will appear in future editions of this newsletter.)

The CRAFTS (Coordinated Research on Alternative Forestry Treatments and Systems) forest vegetation management research cooperative at Oregon State University has developed an interactive computer program that is designed to assist foresters with the selection of vegetation management treatments. The program is called VEGPRO, an abbreviation for Forest Vegetation Management Prescription Optimization and Information System. VEGPRO contains the most current information available on herbicide and manual treatments for forest vegetation in the Pacific Northwest. The program is designed to handle site preparation, release, and individual plant treatments for 1) deciduous woody vegetation in the Coast and Cascade Ranges, 2) mixed sclerophyll vegetation in southwestern Oregon and northern California, and 3) herbaceous vegetation.

To use the program, the target-species composition and treatment costs are entered for a particular

forest site that is being considered for treatment. VEGPRO then uses a treatment efficacy data base and user-determined treatment selection criteria to choose the best treatment for a particular situation. The treatments are ranked based on the amount of vegetation remaining after treatment, treatment costs, and cost efficiency. The user can modify the data base for the program to conform to local experience and expertise, or update the data base with information on new treatments.

In addition, the user can access a treatment guideline window that contains information about each treatment. Specific information for each herbicide treatment includes the rate, carrier, timing, and adjuvants that were used in developing the data base. Additional information in this window includes the herbicide's manufacturer, chemical name, mode of action in the plant, toxicity, and environmental characteristics. The current registration status for each treatment in Oregon, Washington, and California, and specific comments related to the use of each treatment are also included. For users that are new to the field, there is also a window that contains a complete glossary of forest vegetation management terms.

When the user is finished with a run, a printout of all information related to the run can be provided. The printout can then serve as documentation for the decision to select a particular vegetation treatment on a specific site. VEGPRO is currently undergoing review and should be available to the public through a marketing company later in the year.

A demonstration of this program is scheduled for the November meeting of the BC Vegetation Management Research Committee in Vancouver (see an earlier section in this newsletter on "upcoming meetings").

Contact: Dr. Robert Wagner, CRAFTS Cooperative, Department of Forest Science, College of Forestry, Oregon State University, Corvallis, Oregon 97331-5704 USA Phone: (503) 754-2244.

●●●●●

COMPUTERIZED DATA BASES
A review of some of the services and facilities available

COMPUTERIZED LITERATURE SEARCHING FROM PUBLIC DATA BASES

Today there are many computerized information retrieval systems which can be used to access hundreds of data bases containing millions of references. The data bases most commonly used in the pursuit of forestry literature are CAB (Commonwealth Agricultural Bureau), BIOSIS (Biological Abstracts) and AGRICOLA (Bibliography of Agriculture). The CAB data base includes entries from Weed Abstracts (1000+ journals), Forestry Abstracts (1000+ journals), Herbage Abstracts (800+ journals),and many other sources. For a specific information request, a carefully planned search of a well defined field can yield rapid results at a reasonable costs. Search results usually include abstracts and are available within minutes. If the full reference is not available locally it can usually be ordered from the data base headquarters.

Ministry of Forests Library in-house literature searching service

Roxanne Smith or Susan Barker at the MoF library in Victoria can arrange literature searches through DIALOG for Ministry staff. The DIALOG system provides access to CAB, AGRICOLA and BIOSIS, the three most commonly used data bases for forestry literature. Roxanne may also suggest a search of CRIS (Current Research Information System) which covers current research topics in agriculture and forestry. A rough estimate of searching costs can be provided once Roxanne is fully aware of your searching needs. Frequently, the cost of a single subject search is not more than US$30. Results can either be printed immediately or saved for reformatting and printing at a later date. There is a charge, per reference, for printed output. This is an in-house service for Ministry staff.

Literature searching services for Industry, Consultants, and other individuals

Some larger forest companies may have staff assigned to on-line literature searching. Anyone without access to such in-house services may wish to contact an "information broker" who will assist in the design of a search profile, recommend data bases for searching and perform the search. The costs associated with this type of private service will reflect the hourly rate of the person performing the search, on-line computing costs and retrieval costs. Information brokers are listed under "Information Services" in the Yellow Pages.

It is also possible for an individual to direct a specific information request to the Canada Institute for Scientific and Technical Information (CISTI) in Ottawa. CISTI has access to over 100 data bases and can provide literature searches on any topic in the field of science and technology. The minimum fee is $30.00 for a single subject search from two data bases. For further information contact CISTI at the following address:

Unified Literature Search Service
Reference and Research Department
Canada Institute for Scientific and Technical Information
National Research Council of Canada
Ottawa, Ontario
K1A 0S2
Phone: (613) 993-2013

Searching example

The following example illustrates some searching procedures using the CAB data base. It is assumed that a qualified librarian or information broker would be assisting in the design and execution of the search.

Researcher's question: *What literature is available that relates to the non-target impacts of Vision – specifically the herbicide's effects on small mammals and aquatic life?*

The specialist performing your search will need to have the topic described fully. Keywords or synonymous terms should be provided whenever possible. Often the searcher will request two or three recent relevant citations as guidance. Searches are conducted on CAB using the Boolean operators, AND, ANDNOT, and OR. The AND is used to restrict retrievals to only those references satisfying both requirements. The OR is used to expand a search to include any other terms, often the synonyms. The OR allows either requirement to be met. The ANDNOT is used to exclude certain terms which could misdirect a search.

For the above example, the searcher would need to know firstly that a search for references relating to the herbicide Vision should include the keywords Roundup and glyphosate. These three terms would be set up as,

VISION OR ROUNDUP OR GLYPHOSATE

The CAB search result from this particular request was 2204 references. By then further restricting the search to Forestry Abstracts (1984-1989), and hopefully not missing any forestry related articles, this result was reduced to 196 references. When this latter result was further restricted with the phrase,

AND NONTARGET EFFECTS

no references were found. However, the restriction,

AND SMALL MAMMALS
OR AQUATIC ANIMALS

yielded one reference.

As so little information was retrieved using this particular data base it would probably be worthwhile to consult other sources such as BIOSIS, or in this case an environmental data base. An experienced information broker or librarian would be able to offer direction in the selection of appropriate data bases.

•••••

COMPUTERIZED FORESTRY DATA BASES

In addition to the public data bases which contain forestry references as one aspect of their more broadly-based coverage, there are several privately maintained computerized information systems which are specific to forestry topics.

- The Weyerhaeuser forestry data base (Centralia, Washington)

- The Inland Empire Vegetation Management Working Group referral/retrieval system (Moscow, Idaho)
- FS-INFO-NW (USDA Forest Service, University of Washington, Seattle)
- Crafts herbaceous vegetation bibliography (in development, Oregon State University, Corvallis)
- The BC Ministry of Forests Reforestation Information Bank (Victoria, BC)
- The BC Ministry of Forests computerized bibliography for competing species (Victoria and UBC)
- The UBC INFORMS computerized vegetation management data base (UBC)

The Weyerhaeuser forestry data base

The Weyerhaeuser Company in Centralia, Washington, has been compiling a forestry data base for more than 10 years. This is a private data base housed on a Vax computer and designed for Weyerhaeuser's in-house use. Donna Loucks is the forestry librarian responsible for the operation of the system. She works half time for Weyerhaeuser and half time as a private information broker available for contract. Through a special arrangement with Weyerhaeuser she is able to provide searches of the Weyerhaeuser data base to individuals outside of the company. She will also provide searches of any of the public data bases outlined earlier in this newsletter.

Some features to note about the Weyerhaeuser data base are that it contains all of the USDA Forest Service publications; it also contains pamphlets, books and proceedings with every title listed in a proceedings or review publication being searchable; the data base does not contain journal articles. Donna can provide copies of any of the material in the data base for minimal cost. There are presently over 17,000 entries on the system in Centralia.

Donna's qualifications as an information broker who has specialized in forestry topics for more than 15 years make her a very useful contact, often utilized by BC foresters. Donna's rates for a data base search are dependant on the complexity of the task, the number of data base searched and the amount of information retrieved.

Contact: Donna Loucks, P.O. Box 638, Centralia, Washington 98531 Phone: (206) 736-2147 (mornings).❑

The Inland Empire Vegetation Management Working Group (IEVMWG) referral/retrieval system

The IEVMWG is based in Moscow, Idaho, at the University of Idaho's Forest Resources Department. The group, formed in 1986, is involved in the development of a contact expertise referral system and a regional vegetation management (VM) data base. The objectives of the data base are to help develop operational management guidelines, to provide supporting data for acquiring state registration of chemicals, and to direct future VM research activities.

Membership in the IEVMWG is made up mostly of regional foresters, but is not restricted and is currently free. All members are asked to submit information on their experiences for entry into the contact expertise referral system, and to complete treatment reporting forms, as applicable, for entry into the regional VM data base. Searching of the VM data base is a service provided to members and is initiated by completing a one-page request form.

Contact: Dave Adams, Executive Secretary, IEVMWG, Forest Resources Department, University of Idaho, Moscow, Idaho 83843 Phone: (208) 885-7953.❑

FS-INFO-NW – a private USDA Forest Service library and information service

FS-INFO-NW is an information network for USDA Forest Service employees. It is a main frame system, located at the University of Washington in Seattle. It can provide access to the USDA library system, all Forest Service publications and special bibliographies.

Although FS-INFO-NW is currently restricted to Forest Service in-house use, there are plans to allow outside access by other individuals, hopefully sometime next year. In the meantime, anyone working on a cooperative project with a USDA FS employee can have access to the system via the

USDA FS cooperator. BC foresters can receive copies of the information system's newsletter, Monthly Alert. Publications announced in the Alert subsequently become part of the FS-INFO-NW data base.

Contact: FS-INFO-NW, University of Washington, Mail Stop AQ-15, Seattle, Washington 98195 Phone: (206) 442-1076.❑

CRAFTS herbaceous vegetation bibliography

CRAFTS (Coordinated Research on Alternative Forestry Treatments and Systems) at Oregon State University is planning to begin work on a new computerized bibliography later this summer. The focus of the bibliography will be on the impacts of herbaceous vegetation in Pacific Northwest forests.

Contact: Tim Harrington, CRAFTS, Department of Forest Science, Oregon State University, Corvallis, Oregon 97331-5704 USA Phone: (503) 754-2244.❑

The BC Ministry of Forests Reforestation Information Bank (RIB)

RIB is a computerized reference system designed to keep silviculture foresters up to date on current research results from government and industry. It has been developed by the BC Ministry of Forests with FRDA funds through the Northern Interior Technical Advisory Committee.

Each RIB entry gives a synopsis of the original report for recently completed forestry research. Summaries of ongoing projects are also included. Each entry provides a contact name, agency affiliation, phone number and references to other studies.

RIB is simple to operate and can be used by anyone with access to an IBM compatible PC system with one floppy drive and a hard disc. The first version of RIB covers research from the Northern Interior of the province. It is hoped to have all coastal research included by the end of March 1990.

Contact: FORMIS Ltd., P.O. Box 1143, Station E, Victoria, B.C. V8W 2T6 Phone: (604) 383-5280.❑

The Ministry of Forests computerized bibliography for competing species

The Ministry of Forests' bibliography of published references relating to the competitive status and autecology of seven southern interior weed species (see INFORMS volume 2#2 pages 7-8) is presently being expanded under FRDA project #3.48 to include six additional species. The species covered by the initial project were Sitka alder, paper birch, pinegrass, fireweed, false azalia and white-flowered rhododendron. The six species presently being added to the bibliography are red-osier dogwood, red raspberry, lady fern, black twinberry, bracken fern and elderberry. Later this summer the data base will be expanded further to include several coastal weed species.

The data base will continue to be structured for use with Ashton Tate's data base manager dBASE III PLUS[1] (or dBASE IV) on an IBM, or compatible, microcomputer. References can be searched by author name, date, title, source or keyword(s), and can be displayed and/or printed. Abstracts can be viewed and printed with most references. A custom-designed searching program facilitates simple menu-driven search and retrieval procedures. All references can be obtained in hard copy from the INFORMS library at UBC.

Contact: Dr. Phil Comeau, Technical Advisor - Vegetation Management, Ministry of Forests, Research Branch, 31 Bastion Square, Victoria B.C. V8W 3E7 Phone: (604) 387-3019.❑

The UBC INFORMS computerized vegetation management data base

The INFORMS computerized bibliography and associated library were created to provide foresters with rapid access to vegetation management information. The material in this data base includes both published and unpublished literature from a variety of sources not always captured by conventional on-line searching techniques.

---

1 Trademark of Ashton Tate, Torrance, California.

Searching of the INFORMS data base is possible through author name, date, title, source, keyword(s) or any combination of these fields. There are presently around 600 keywords in use covering a wide variety of specific topics (see the listing at the end of this newsletter).

The INFORMS data base is maintained on the UBC mainframe computer with searches being performed, as requested, by the INFORMS project manager Susan Watts. All material in the data base is also housed in the INFORMS library as a hard copy, and can be photocopied as needed.

Recently a system has been developed to facilitate downloading of the mainframe data base contents to a dBASE III PLUS system. This microcomputer format allows for independent access and searching of the data base by any interested microcomputer users. A "user friendly" searching program has been designed to simplify the dBASE III PLUS searching routines.

Further details concerning INFORMS mainframe and microcomputer searching procedures are provided in the following section of this newsletter.

Contact: Dr. Susan B. Watts, UBC INFORMS Project, Forest Science Department, Faculty of Forestry, University of British Columbia, 2357 Main Mall, Vancouver, B.C. V6T 1W5 Phone: (604) 228-6316.❑

•••••

THE INFORMS COMPUTERIZED VEGETATION MANAGEMENT DATA BASE

An update on mainframe and microcomputer searching procedures

Until recently, the INFORMS data base has been available only on mainframe support at UBC with no direct access possible for any individuals located away from campus. However, recent modifications to the system have facilitated downloading of the data base for use with dBASE III PLUS software and a suitable microcomputer system.

Although the information stored on the two systems is identical (it is entered on the mainframe and downloaded to dBASE periodically), the searching abilities differ somewhat between the systems. All mainframe searching is done by Susan Watts at the request of interested individuals. The microcomputer version of the data base can be searched by anyone with an installed version of dBASE III PLUS and a suitable computer set up. At the present time, mainframe searching offers the speediest and most specific searching possibilities. Keywords presently in use are listed towards the end of this newsletter.

Mainframe data base searching requests

References in the INFORMS data base (mainframe version) can be accessed in a variety of ways. Searches can be performed on a basis of author name(s), publication date, article title, source, or keyword(s). Also, any combination of these field names can be connected in one search; several variables can be provided for one field name search, and specific restrictions to a search can be added as required.

For example, a search can be as simple as,

> FIND KEYWORD GARLON

or,

> FIND KEYWORD DOUGLAS-FIR AND KEYWORD MANUAL CONTROLS

or as complex as,

> FIND KEYWORD GARLON OR KEYWORD TRICLOPYR AND DATE 1988 AND NAME SMITH

Restrictions can be added, such as,

> FIND NAME BROWN FROM 1980 TO 1985 (This includes '80 and '85)

or,

> FIND KEYWORD GLYPHOSATE BEFORE 1987 (This excludes '87)

or,

> FIND KEYWORD CONIFER RELEASE AFTER 1980 (This excludes '80)

All material in the data base is also housed as a hard copy in the INFORMS library.

Contact: Searching is done by Susan Watts at the request of interested individuals. For further details call Susan at (604) 228-6316.❑

Searching the data base using dBASE III PLUS

The mainframe version of the INFORMS data base can be downloaded for use with Ashton Tate's data base manager dBASE III PLUS and a suitable microcomputer.

Individuals familiar with dBASE III PLUS searching procedures will be able to search the data base fully. For those individuals not familiar with this software package a customized searching program (SEARCH.prg) is included with each downloaded disc. The SEARCH program generates a series of simple questions, the answers to which will lead to a specific search being performed. At the present time this searching program is designed for use on one field name (author, title, source, or keyword) plus one variable per search. Future modifications to this program will allow greater searching flexibility.

The SEARCH program prompts for responses to the following questions:

NAME OF FILE TO SEARCH:

PRINTED OUTPUT (Y/N):

SAVE RESULTS TO A FILE (Y/N):

PAUSE BETWEEN RECORDS (Y/N):

KEYWORDS DISPLAYED (Y/N):

FIELD TO SEARCH: (Type one field name - AUTHOR, TITLE, SOURCE or KEYWORD)

STRING TO LOCATE: (Type one variable for searching in the field named above)

DO YOU WISH TO SEARCH FOR MORE STRINGS (Y/N):

As with the mainframe version of the INFORMS data base, each reference can be identified by its own reference number. This number appears in the field name "NO". The number can be used for subsequent retrieval of a hard copy of the reference from the INFORMS library.

Contact: Additional information on the SEARCH program is provided with each disc request - see the registration form at the end of this newsletter. Further information on this new version of the INFORMS data base can be obtained from Susan Watts, INFORMS Project Manager, Forest Science Department, Faculty of Forestry, University of British Columbia, 2357 Main Mall, Vancouver, B.C. V6T 1W5 Phone: (604) 228-6316.❑

INFORMS Data Base Keyword Listing

1. **WEED AND CROP SPECIES**

ALDER
ANNUAL GRASS
ASPEN
BACCHARIS
BALSAM FIR
BALSAM POPLAR
BASSWOOD
BEAKED HAZEL
BEARGRASS
BIG TOOTH ASPEN
BIGLEAF MAPLE
BIRCH
BLACK CHERRY
BLACK COTTONWOOD
BLACK HUCKLEBERRY
BLACK OAK
BLACK SPRUCE
BLACK TWINBERRY
WALNUT
BLACKBERRY
BLUE JOINT
BRACKEN
BRACKEN FERN
BROOMSEDGE
CALAMAGROSTIS
CANYON LIVE OAK
CARIBBEAN PINE
CASCARA
CEANOTHUS
CHERRY
COTTONWOOD
CRANBERRY
DEERBRUSH
DEVILS CLUB
DOGFENNEL
DOUGLAS MAPLE
DOUGLAS-FIR
EASTERN WHITE PINE
ELDERBERRY
ENGELMANN SPRUCE
FALSE AZALEA
FESCUE
FIR
FIREWEED
FORBS
GAMEL OAK
GOLDENROD
GRAND FIR
GRAND PINE
GRASSES
GREEN ALDER
GREEN ASH
HAZEL
HERBACEOUS WEEDS
HERBS
HUCKLEBERRY
INCENSE CEDAR
JACK PINE
JEFFREY PINE
KALMIA
KNAPWEED
LADY FERN
LARCH
LOBLOLLY PINE
LODGEPOLE PINE
LONGLEAF PINE
MADRONE
MANZANITA
MAPLE
MENZIESIA
MOUNTAIN ALDER
MOUNTAIN ASH
MOUNTAIN MAPLE
MOUNTAIN WHITETHORN
NINEBARK
NOBLE FIR
NORWAY SPRUCE
OCEANSPRAY
OREGON OAK
PANICUM
PAPER BIRCH
PAULOWNIA
PERENNIAL GRASS
PIN CHERRY
PINE GRASS
PINEWEED
PINUS PALUSTRIS
PINUS PONDEROSA
POISON OAK
POKEWEED
PONDEROSA PINE
QUAKING ASPEN
RAGWEED
RANGE WEEDS
RASPBERRY
RED ALDER
RED ELDERBERRY
RED FIR
RED MAPLE
RED OAK
RED RASPBERRY
RED TWINBERRY
RED-OSIER DOGWOOD
REDROOT
REDSTEM CEANOTHUS
RHODODENDRON
RIBES
ROCKY MOUNTAIN MAPLE
ROSE
RUBUS IDEAUS
RUBUS LACINIATUS
RUBUS PROCERUS
SALAL
SALMONBERRY
SASSAFRAS
SCOTCHBROOM

SCOTS PINE
SEDGE
SERVICEBERRY
SHASTA RED FIR
SILVER MAPLE
SITKA ALDER
SITKA SPRUCE
SLASH PINE
SLICKLEAF CEANOTHUS
SNOWBERRY
SNOWBRUSH
SPRUCE
ST. JOHN'S WORT
STINK CURRANT
SUGAR PINE
SUMACS
SWEET GUM
SWORD FERN
TANOAK
THIMBLEBERRY
TREMBLING ASPEN
VACCINIUM
VARNISHLEAF CEANOTHUS
VINE MAPLE
WESTERN HAZEL
WESTERN HEMLOCK
WESTERN LARCH
WESTERN RED CEDAR
WESTERN SPRUCE
WESTERN WHITE PINE
WHITE ASH
WHITE BIRCH
WHITE FIR
WHITE PINE
WHITE SPRUCE
WILD ROSE
WILLOW

2. WEED AND CROP ECOLOGY

BIOMASS STUDIES
CARBOHYDRATE RESERVES
CROP MORPHOLOGY
CROP PHYSIOLOGY
NITROGEN CYCLING
NUTRIENT ANALYSIS
NUTRIENT CYCLING
OVERSTORY-UNDERSTORY CONDITIONS
POPULATION ECOLOGY
ROOT RESEARCH
SHRUB PHENOLOGY
SUCCESSION
VEGETATIVE REPRODUCTION
WEED AUTECOLOGY
WEED DENSITY
WEED PHYSIOLOGY

2.1 COMPETITION

ALLELOPATHY
COMPETITION
COMPETITION INDICES
COMPETITION THRESHOLDS
CROP RESPONSE
CROP STAGNATION
CROP/WEED INTERACTIONS
FREE-TO-GROW
INTERFERENCE
LIGHT
LIGHT RESPONSES
LIMITING FACTORS
NUTRIENTS
OVERTOPPING ASSESSMENT
SITE FACTORS
SOIL MOISTURE
SOIL NUTRIENTS
SOIL WATER POTENTIAL
WATER
WATER STRESS
WEED DENSITY
WEED RESPONSE

2.2 ENVIRONMENTAL FACTORS

FOLIAR N
LIGHT
LIGHT RESPONSES
MOISTURE
PHOTOTOXICITY

3. BASIC AND INTENSIVE SILVICULTURAL ACTIVITIES

BRUSHING
CLEANING THINNING
CONIFER RELEASE
DECIDUOUS TREE CONTROL
FERTILIZATION
HERBACEOUS WEED CONTROL
NURSERIES
OVERSTORY REMOVAL
PLANTING METHODS
REGENERATION
RELEASE TREATMENTS
SILVICULTURAL TREATMENTS
SITE PREPARATION
SITE REHABILITATION
STAND MANAGEMENT
STAND RELEASE
STOCK CONTROL
THINNING
WOODY WEED CONTROL

4. SILVICULTURAL POLICY AND PLANNING

DEFINING BRUSH PROBLEMS
FEDERAL LAW
FEDERAL POLICY
GUIDELINES
INTEGRATED VEGETATION MANAGEMENT
IPM
NSR STATISTICS
PLANNING
PLANNING - GUIDELINES
POLICY
PRESCRIPTIONS
PROTOCOL
PUBLIC ATTITUDES
PUBLIC RELATIONS
SECTION 88
TREATMENT PRIORITIES
TREATMENT SELECTION
YIELD FORECASTING
YIELD RESPONSES

5. ECONOMICS OF SILVICULTURE

CONTROL COSTS
COST EFFECTIVENESS ANALYSIS
COST/BENEFIT ANALYSIS
ECONOMIC BENEFIT ANALYSIS
NSR STATISTICS
REGENERATION COSTS
RISK ANALYSIS
SECTION 88
SILVICULTURAL BENEFITS
TREATMENT PRIORITIES
WEED ASSESSMENT
YIELD RESPONSES

6. METHODS OF SITE PREPARATION AND VEGETATION MANAGEMENT

6.1 CHEMICAL CONTROLS

AATREX
ACME 500
ALACHLOR
ALLY
AMITROLE
AMMONIUM SULPHAMATE
AMMONIUM SULPHATE
AMPA
ARSENAL
ASSURE
ASULAM
ASULOX F
ATRAZINE
BANVEL
BASAGRAN
BENAZOLIN
BIFENOX
CACODYLIC ACID
CARAGARD
CASORON
CHEMICAL CONTROLS
CHLORTHAL
CINCH
CINMETHYLIN
CLOPYRLID
DALAPON
DAZOMET
DCNA
DCPA
DICAMBA
DICHLOBENIL
DICHLOROPROP
DIFLUBENZURON
DINOSEB
DIOXIN
DIPHENAMID
DPX-L5300
ENIDE
ESCORT
ESTERON
ESTERON 99
ETHOMEEN C12
ETHOMEEN T25
EXPRESS
FORESTAMINE GUARDMAN
FORESTER ESTERON
FURLOE
GARLON
GARLON 3A
GARLON 4
GARLON 1
GLYPHOSATE
GOAL
GOAL 2E
GRASS CONTROL
H&S
HERBICIDE INJECTION
HERBICIDES GENERAL
HEXAZINONE
HOE-00661
IMAZAPYR
KRENITE
LACTOFEN
LONTREL
MECOPROP
METALAXYL
METSULFURON METHYL
METHYL BROMIDE
METSULFURON
MEXACARBAMATE
MSMA
NAPROPAMIDE
NC-28858
ORYZALIN
OUST
OXADIAZON
OXYFLUORFEN
PARAQUAT
PHENOXY HERBICIDES

PICLORAM
POAST
PPG-1013
PPG-1259
PPX-T6376
PRINCEP
PROMETRYN
PRONAMIDE
PRONONE
PROPAZINE
ROUNDUP
SCEPTER
SC0051
SC0574
SC0774
SETHOXYDIM
SILVEX
SIMAZINE
SITE PREPARATION-CHEMICAL
SPIKE
SULFOMETURON
SULFOMETURON METHYL
TCDD
TEBUTHIURON
TERBACIL
THIRAM
TORDON
TORDON 101
TORDON 2
TRIADIMEFON
TRIAZINES
TRICLOPYR
OUST
VELPAR
VELPAR L
VELPAR ULV
VERDICT
VISION
VORLEX
WEEDONE
ZECTRAN
1,3-DICHLOROPROPENE
2,2-D
2,2-DPA
2,4-D
2,4-D AMINE
2,4-D ESTER
2,4-DP
2,4,5-T

6.1.1 HERBICIDE APPLICATION
AERIAL APPLICATION
APPLICATION METHODS
APPLICATION TEMPERATURE
BUFFER ZONES
CALIBRATIONS
CHEMICAL CONTROLS
DRIFT
FEDERAL LAW
FORMULATIONS
H&S
HERBICIDE INJECTION
HERBICIDE RATE-TIMING
HERBICIDE REGISTRATION
HERBICIDE REGULATIONS
HERBICIDE SCREENING
HERBICIDE SPRAY
MONITORING
HERBICIDE USE STATISTICS
LEGISLATION
MIXING
PEST CONTROL PRODUCTS ACT
PESTICIDE REFORMS
PESTICIDE REGULATIONS
POST-EMERGENCE SPRAY
PRE-EMERGENCE SPRAY
SPOT TREATMENTS
SPRAY DEPOSITS
SPRAY TECHNOLOGY
STEM INJECTIONS
STUMP TREATMENT
THIN-LINE APPLICATIONS

6.1.2 HERBICIDE BEHAVIOUR AND EFFICACY
CHEMICAL CONTROLS
CROP DAMAGE
CROP RESPONSE
DRIFT
ENVIRONMENTAL IMPACTS
FISH RESPONSE
FORAGE IMPACTS
HAZARD ASSESSMENT
HERBICIDE BEHAVIOUR
HERBICIDE BREAKDOWN
HERBICIDE DAMAGE
HERBICIDE EFFICACY
HERBICIDE IMPACT STUDIES
HERBICIDE ISSUES
HERBICIDE MOVEMENT
HERBICIDE PROPERTIES
HERBICIDE RESIDUES
HERBICIDE SCREENING
HERBICIDES ECOLOGICAL EFFECTS
HERBICIDES ENVIRONMENTAL IMPACTS
HERBICIDES MOA
PHYTOTOXICITY
RUNOFF
SOIL MOVEMENT
SOIL RESIDUES
SOIL RESPONSES
SOIL TOXICITY
STREAMWATER RESIDUES
SURFACTANT
TOXICITY

6.1.3 **HEALTH ASPECTS**
CARCINOGENS
DRIFT
ENVIRONMENTAL IMPACTS
HAZARD ASSESSMENT
HERBICIDE ISSUES
HERBICIDE REGISTRATION
HERBICIDE REGULATIONS
HERBICIDE RESIDUES
HERBICIDES ENVIRONMENTAL PROTECTION
HERBICIDES HEALTH RISKS
HUMAN EXPOSURE
LEGISLATION
PEST CONTROL PRODUCTS ACT
PESTICIDE REGULATIONS
PESTICIDE SAFETY
PUBLIC ATTITUDES
PUBLIC PERCEPTION
RESIDUE ANALYSIS
RUNOFF
SOIL RESIDUES
SOIL TOXICITY
STREAMWATER RESIDUES
TOXICITY
TOXICITY TESTING
TOXICOLOGY

6.2 **FIRE**
FIRE
PRESCRIBED BURNING
SLASHBURNING

6.3 **MECHANICAL**
INVERTING
MECHANICAL CONTROLS
MOUNDING
MOWING
MULCHING
SCALPING
SCARIFICATION
SCREEFING
SITE PREPARATION-MECHANICAL
SITE PREPARATION EQUIPMENT

6.4 **MANUAL**
BRUSHSAWS
GIRDLING
H&S
HERBICIDE INJECTION
MANUAL CONTROLS
NOTCHING
SITE PREPARATION-MANUAL
SITE PREPARATION EQUIPMENT

6.5 **BIOLOGICAL**
BIOLOGICAL CONTROLS
COVER CROPS
SHEEP

6.6 **OTHER METHODS**
FERTILIZATION
INTERPLANTING
OVERSTORY REMOVAL
PROPHYLACTIC MEASURES
SHELTERWOODS

7. **OTHER IMPACTS OF VEGETATION MANAGEMENT**

AQUATIC IMPACTS
BERRY FRUITS
BERRY PRODUCTION
BUFFER ZONES
DAPHNIA
DRIFT
ENVIRONMENTAL IMPACTS
FISH RESPONSE
FORAGE IMPACTS
HERBICIDE IMPACT STUDIES
HERBICIDES ECOLOGICAL EFFECTS
HERBICIDES ENVIRONMENTAL IMPACTS
HERBICIDES HEALTH RISKS
NON-TARGET IMPACTS
RESIDUE ANALYSIS
RIPARIAN HABITAT
RUNOFF
WILDLIFE

8. **RESEARCH METHODS**

ADDITION SERIES
EXPERIMENTAL DESIGN
NEIGHBOURHOOD EXPERIMENTS
NELDER PLOTS
PHOTOGRAPHY
PLANT GROWTH ANALYSIS
REPLACEMENT SERIES
RESEARCH METHODS
SPACING EXPERIMENTS
25 YEAR STUDY
5 YEAR STUDY
8 YEAR STUDY

9. **RESEARCH PLANNING**

EXPERIMENTAL DESIGN
GUIDELINES
PROTOCOL
PUBLIC EDUCATION
RESEARCH PRIORITIES
RESEARCH STRATEGIES

10. AGENCIES AND ORGANIZATIONS

ABCPF
AUBURN
BCFS
CFA
CFS
COFI
COOPERATIVES
CPPA
CRAFTS
DUPONT
ECW
EPA
EXTENSION
F.I.R.
FPMI
FRDA
IUFRO
MOF
MOFL
MONSANTO
NCASI
NILS
NRC
POTLATCH
SCHIRP
SFU
SISCO
USDA
WCB

11. STUDY AREAS

CARNATION CREEK
DEMONSTRATION SITES
HANEY
MARC WATERSHED
SIUSLAW NATIONAL FOREST
SKEENA RIVER

12. REGIONS

ALASKA
GREAT BRITAIN
INTERIOR
NORWAY
OREGON
OSU
PACIFIC NORTHWEST
PEACE RIVER
POWELL RIVER
QUEENSLAND
S. INTERIOR
SBS ZONE
SOUTHEASTERN USA
SWEDEN

13. INFORMATION SYSTEMS

ANNOTATED BIBLIOGRAPHY
BIBLIOGRAPHY
EXTENSION
INFORMATION SYSTEMS
LITERATURE SURVEY

14. REPORTS/PROCEEDINGS

AUBURN ANNUAL REPORT
GLOSSARY
GUIDELINES
HANDBOOK
PROBLEM ANALYSIS
PROCEEDINGS
PROJECT PROPOSAL
RESEARCH REVIEW
WORKING PLAN
25 YEAR STUDY
5 YEAR STUDY
8 YEAR STUDY

15. MODELLING

FORCYTE
MODELLING
YIELD FORECASTING
YIELD RESPONSES

16. MISCELLANEOUS

AGROFORESTRY
BIOMASS STUDIES
BIOTECHNOLOGY
FUSIFORM RUST
HARVESTING PRACTICES
MYCORRHIZA RESPONSE
NITROGEN
ROOT RESEARCH
ROW WEED CONTROL
STREAM CHEMISTRY
STREAMWATER NUTRIENTS
STREAMWATER QUALITY
VEGETATION CLASSIFICATION
VEGETATION MANAGEMENT GENERAL